Docket No.: M0925.70067US00
(PATENT)

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant:	Vanessa Z.H. Chan et al.
Serial No.:	09/720,710
Confirmation No.:	5662
Filed:	July 2, 1999
For:	PERIODIC POROUS AND RELIEF NANOSTRUCTURED ARTICLES
Examiner:	V. S. Chang
Art Unit:	1794

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Dated: June 30, 2008 Signature: ____________ (Tina M. Hanifin)

APPEAL BRIEF

Mail Stop Appeal Brief - Patents
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Sir:

As required under § 41.37(a), this brief is filed more than two months after the Notice of Appeal filed in this case on November 30, 2007, and is in furtherance of said Notice of Appeal.

The fees required under § 41.20(b)(2) are dealt with in the accompanying TRANSMITTAL OF APPEAL BRIEF.

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This brief contains items under the following headings as required by 37 C.F.R. § 41.37 and M.P.E.P. § 1205.2:

Appendix B Evidence Submitted (37 C.F.R. §41.37(c)(1)(ix))

Appendix C Related Proceedings (37 C.F.R. §41.37(c)(1)(x))

I. REAL PARTY IN INTEREST (37 C.F.R. §41.37(c)(1)(i))

The real party in interest in this application is the assignee, Massachusetts Institute of Technology, a university having a place of business at 77 Massachusetts Avenue, Cambridge, Massachusetts 02139.

II. RELATED APPEALS AND INTERFERENCES (37 C.F.R. §41.37(c)(1)(ii))

There are no other appeals, interferences, or judicial proceedings which will directly affect or be directly affected by or have a bearing on the Board's decision in this appeal.

III. STATUS OF CLAIMS (37 C.F.R. §41.37(c)(1)(iii))

A. Total Number of Claims in Application

This case was initially filed with 148 claims (claims 1-148). There are currently 4 claims pending and under consideration. The status of each of the claims as initially filed is summarized below. A copy of the claims as pending is attached as Appendix A.

B. Current Status of Claims

1. Claims canceled: None.

2. Claims withdrawn from consideration but not canceled: 2-16, 18-22, and 25-148.

3. Claims pending: 1-148.

4. Claims allowed: None.

5. Claims rejected: 1, 17, 23, and 24.

C. Claims On Appeal

The claims on appeal are claims 1, 17, 23, and 24.

IV. STATUS OF AMENDMENTS (37 C.F.R. §41.37(c)(1)(iv))

No amendments to the claims or specification have been filed subsequent to the Final Office Action of August 30, 2007.

V. SUMMARY OF CLAIMED SUBJECT MATTER (37 C.F.R. §41.37(c)(1)(v))

This invention is directed generally to polymeric articles which can be made into porous and relief nanostructures and, in some embodiments, ceramic articles. The polymeric articles exhibit a periodic structure arranged into separate domains within the structure, with the separate domains characterized by a different chemical composition and/or set of physical properties. The periodic structure may exhibit one-, two-, or three-dimensional periodicity. Certain embodiments of the invention provide a "three-dimensionally periodic structure," which refers to a periodic structure of domains arranged such that, when the structure is oriented in a three-dimensional coordinate system with mutually orthogonal x, y, and z component directions, a straight line drawn through the periodic structure in any direction will intersect at least two separate domains at regular intervals

(page 12, lines 10-13 of the specification[1]). Furthermore, certain embodiments of the invention include three-dimensionally periodic structures having at least two domains which are "topologically continuous," i.e., domains which are continuous in the sense that a particular domain in the periodic, polymeric structure forms a continuous pathway through the structure (page 13, line 32 – page 14, line 2 of the specification).

The invention provides embodiments wherein a porous, polymeric article is produced by selective removal of at least one domain from a three-dimensionally periodic structure. For example, a three-dimensionally periodic structure may include a first, polymeric domain and a second, polymeric domain that forms an inorganic oxide ceramic. Selective removal of the first, polymeric domain and formation of a ceramic from the second, polymeric domain can provide a porous, ceramic structure. In certain embodiments, the three-dimensionally periodic structure includes a domain comprising a polymeric species containing an inorganic species capable of forming a ceramic oxide, wherein the inorganic species is present in the domain in an amount of at least about 3 atomic % based on the total number of atoms in the domain.

An example of a structure that meets the requirements of the claims under consideration is shown in Figure 4 of the specification (below). Figure 4 shows a double gyroid structure 32, and includes three separate, topologically continuous domains, including domains 20 and 22. In the section illustrated, domain 22 is contained within domain 20. Double gyroid structure 32 is a three-dimensionally periodic structure comprising separate domains arranged such that, when the structure is oriented in a three-dimensional coordinate system, a straight line drawn through the periodic structure in any direction (e.g. any one of lines A, B, or C) intersects at least two separate domains at regular intervals (e.g. at points •). Furthermore, double gyroid structure 32 comprises at least two, topologically continuous domains (e.g., domain 20 and domain 22) that are continuous in the sense that domains 20 and 22 each form a continuous pathway through the structure.

[1] In all instances herein where reference to the specification of the application is made, references is made to the corresponding published PCT application (International Patent Publication WO 00/02090), a copy of which is enclosed as Appendix D.

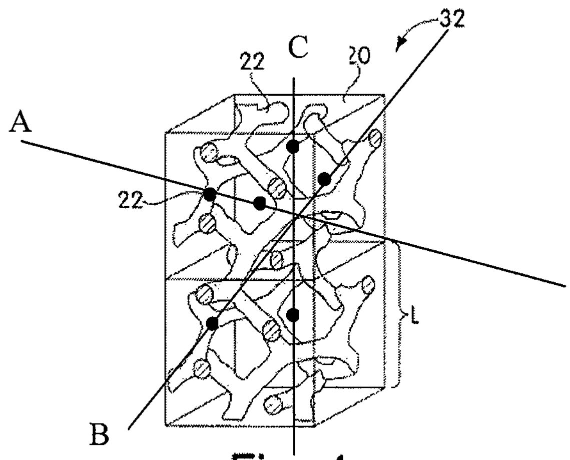


Fig. 4

Polymeric articles of the invention can include pores having a shape and/or size reflected by the arrangement of domains in a periodic structure, prior to selective removal of a domain to form the porous structure. For example, a three-dimensionally periodic structure may include at least two topologically continuous domains, such that selective removal of one, topologically continuous domain produces a porous structure having a topologically continuous pore. Polymeric structures having a three-dimensionally periodic structure and topologically continuous pores can be advantageous in that transport across the polymeric structure in any general direction can occur without having to cross numerous interfaces between two types of different domains. Therefore, the transport paths may be continuous in all directions. This is particularly advantageous in producing nanoporous membranes having high throughput.

VI. GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL (37 C.F.R. §41.37(c)(1)(vi))

A. Whether claims 1, 17, and 23 are unpatentable under 35 U.S.C. §102(b) as anticipated by Lee et. al., *Macromolecules* **1989**, *22*, 2602-2606 ("Lee").

B. Whether claim 24 is unpatentable under 35 U.S.C. §102(b) as anticipated by Lee.

C. Whether claim 24 is unpatentable under 35 U.S.C. §103(a) as obvious over Lee.

VII. ARGUMENT (37 C.F.R. §41.37(c)(1)(vii))

A. Lee does not anticipate or render unpatentable any of claims 1, 17, and 23.

Lee is directed to porous membranes prepared from block copolymers having lamellar, cylindrical, and spherical domains. The Final Office Action dated 08/30/07 states that "the resulting porous membrane[s] reveal that the periodic microstructures of the original block copolymer are directly reflected in the shape and size of the micropores." Thus, as conceded by the Examiner, the porous membranes disclosed Lee include only lamellar, cylindrical, or spherical periodic microstructures.

1. The rejection of claim 1 as anticipated by Lee should be reversed because Lee fails to disclose or suggest a three-dimensionally periodic structure, and Lee fails to disclose or suggest at least a first and a second domain, each being topologically continuous.

Lee cannot anticipate claim 1 because it does not disclose a polymeric structure comprising both (1) a "three-dimensionally periodic structure," and (2) a plurality of periodically occurring separate domains, with at least a first and a second domain each being "topologically continuous," as required by claim 1.

The Examiner in the Final Office Action maintains that Lee teaches a polymeric article including a three-dimensionally periodic structure of a plurality of periodically occurring separate domains, with at least a first and a second domain each being topologically continuous, and with said first domain comprising a polymeric species containing an inorganic species capable of forming a ceramic oxide, said inorganic species present in an amount of at least about 3 atomic %

based on the total number of atoms in the first domain, as recited in claim 1. While Applicants appreciate that, during patent examination, the pending claims must be given their broadest *reasonable* interpretation *consistent with the specification* (see MPEP §2111), the interpretations of the terms "three-dimensionally periodic structure" and "topologically continuous" applied by the Examiner are not reasonable in light of the specification.

The term "three-dimensionally periodic structure" is specifically defined and consistently used in the specification to describe a "structure which can be oriented in the three dimensional coordinate system so that straight lines in all three component directions may pass through the structure and intersect at regular intervals at least two separate domains." (See, for example, page 12, lines 10-14 of the specification.) Furthermore, the term "topologically continuous" is specifically defined and consistently used in the specification to describe a domain that is "continuous in the sense that a particular domain in a periodic, polymeric structure forms a continuous pathway through the structure." (See, for example, page 13, line 32 – page 14, line 2 of the specification.) When an applicant has specifically defined terms used in the claims in the specification, as here, it is the Applicant's definitions that control.

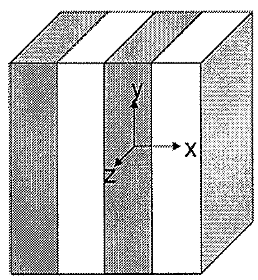
The Lee reference by contrast discloses porous membranes which do not include both a three-dimensionally periodic structure and at least two topologically continuous domains. Rather, the Lee reference discloses only porous membranes prepared from block copolymers having *one-dimensionally* periodic structures of lamellar domains or having *two-dimensionally* periodic structures of cylindrical domains or having three-dimensionally periodic structures of spherical domains, which are *not topologically continuous*.

As explained in Applicant's specification, a one-dimensionally periodic structure, such as the lamellar structure of Lee, cannot be oriented in a three dimensional coordinate system such that a straight line in <u>each of the three</u> component directions intersects at least two separate domains at regular intervals, but rather for a one-dimensionally periodic lamellar structure, a straight in only one of the three component directions can intersect at least two separate domains at regular intervals (e.g. page 12, lines 3-6 of the specification).

For example, as shown in Figure A below, a periodic structure of separate lamellar domains, represented by gray portions and white portions, cannot be oriented in a three-dimensional

coordinate system such that a straight line in any coordinate direction through the structure intersects at least two separate domains at regular intervals. As shown in Figure A, while a straight line along the x-axis may intersect at least two separate domains (e.g., both the gray domains and white domains) at regular intervals, a straight line along the y-axis or along the z-axis intersects only one domain (e.g., only a gray domain or only a white domain). Thus, a periodic structure of separate lamellar domains does not exhibit a three-dimensionally periodic structure, but rather exhibits a one-dimensionally periodic structure.

Figure A. A periodic structure including lamellar domains.



Lee also describes a *two-dimensionally* periodic structure of cylindrical domains. As with a one-dimensionally periodic lamellar structure, however, a two-dimensionally periodic structure cannot be oriented in a three dimensional coordinate system such that a straight line in each of the three component directions intersects at least two separate domains at regular intervals, but rather for a two-dimensionally periodic cylindrical structure, a straight in only two of the three component directions can intersect at least two separate domains at regular intervals (page 12, lines 6-9 of the specification).

As shown in Figure 3 of the specification (reproduced below), which illustrates a two-dimensionally periodic structure with cylindrical domains, while straight lines along the x-axis and along the z-axis may intersect at least two separate domains (e.g., both domains 20 and 22) at regular intervals, a straight line along the y-axis intersects only one domain (e.g., only domains 20

or only domain 22). Thus, a periodic structure of cylindrical domains does not exhibit a three-dimensionally periodic structure, but rather exhibits a two-dimensionally periodic structure.

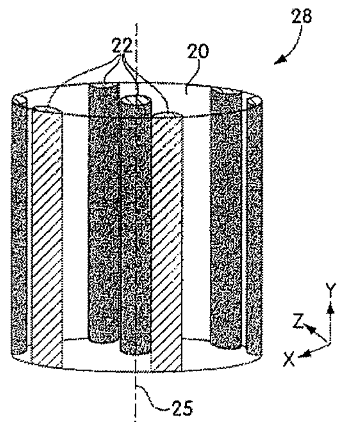


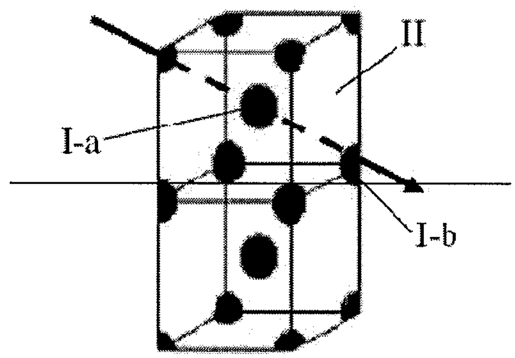
Fig. 3.

Finally, Lee also discloses porous membranes prepared from block copolymers having spherical domains. While these copolymers are three-dimensionally periodic, they do not include at least two topologically continuous domains that each form a continuous pathway through the three-dimensionally periodic structure, as required by claim 1.

By contrast, the spherical domains described in Lee are "discrete" domains that are physically isolated from, and not in physical contact with, other like domains in the structure (e.g., page 14, lines 8-10 of Applicant's specification) and do not form a continuous pathway through the structure.

Figure B illustrates a periodic structure of spherical domains, wherein domain I is contained within domain II and the dotted line indicates a pathway connecting two spheres (e.g., portions I-a and I-b) of domain I. As shown in Figure B, one cannot draw a single, continuous pathway for domain I through the structure without crossing through the domain II surrounding the spheres. Thus, spherical domain I is not topologically continuous, as the term is defined in the specification. While domain II is, itself, topologically continuous, the structures does not include both a first *and a second* domain that are each topologically continuous, as required by claim 1.

Figure B. A periodic structure including spherical domains.



Because each claim limitation is not taught or suggested by Lee, claim 1 is patentable over Lee. Dependent claims 17 and 23 stand or fall with claim 1.

B. The Lee reference does not anticipate or render unpatentable claim 24.

Claim 24 further limits claim 1 by requiring that the polymeric species comprise polymers having an average molecular weight of at least about 30,000 Da. Applicant notes that Lee does not teach or suggest that any of the polymeric species used to form the structures disclosed in Lee include polymers having an average molecular weight of at least about 30,000 Da. Rather, the Examiner has calculated an average molecular weight of 22,000 Da based on an average degree of polymerization (e.g., n = 100) disclosed in Lee. However, this calculation teaches only polymers having molecular weights not exceeding 22,000 Da, an amount which differs nearly 30% from the average molecular weight recited in claim 24 (e.g., at least about 30,000 Da). For this additional reason, Lee cannot anticipate claim 24.

C. Claim 24 is not obvious over the Lee reference.

To support a *prima facie* case of obviousness under 35 U.S.C. §103(a), the Patent Office is required to provide a clear articulation of a reason why the claimed invention would have been

obvious in view of the references (See MPEP §2141). In the present case, however, the Examiner has not provided a reason as to why one of ordinary skill in the art would modify Lee to predictably produce the invention as claimed, or how one skilled in the art would combine known elements, or substitute one known element for another, to predictably arrive at the invention as claimed.

1. The rejection of claim 24 should be reversed because the underlying basis of the rejection – that independent claim 1 is anticipated by Lee – is incorrect.

The underlying premise of the rejection of claim 24 as obvious over Lee is based upon the allegation that Lee anticipates each and every limitation of independent claim one, and that the additional limitation added by claim 24 is only an obvious modification of the Lee disclosure anticipating claim 1.

However, as established above, Lee does not anticipate or otherwise render unpatentable claim 1, so that the basis for the present rejection is invalid. For this reason alone, this rejection should be reversed.

2. The rejection of claim 24 should be reversed because Lee fails to render obvious any structure comprising both a three-dimensionally periodic structure and at least a first and a second domain, wherein each domain is topologically continuous.

To the extent that the obviousness rejection of claim 24 can be viewed an implicit rejection of claim 1 as obvious over Lee, the Examiner has failed to make a *prima facie* case for obviousness, because the rejection fails to establish any reason as to why one of ordinary skill in the art would have modified Lee to produce the invention as claimed, nor has the Examiner even alleged that such modification was within the level of skill of one of ordinary skill in the art or would have yielded a predictable result. For this additional reason, this basis for rejection should be reversed.

VIII. Conclusion

For the foregoing reasons, each of the rejections of the claims was improper and should ne reversed.

Dated: 06/30/08

Respectfully submitted,

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APPENDIX A - CLAIMS AS APPEALED (37 C.F.R. §41.37(C)(1)(VIII))

Claims Involved in the Appeal of Application Serial No. 09/720,710

1. (Original) A system comprising:

a polymeric article including a three-dimensionally periodic structure of a plurality of periodically occurring separate domains, with at least a first and a second domain each being topologically continuous, and with said first domain comprising a polymeric species containing an inorganic species capable of forming a ceramic oxide, said inorganic species present in an amount of at least about 3 atomic% based on the total number of atoms in the first domain.

2. (Withdrawn) A system comprising:

a polymeric article including a periodic structure of a plurality of periodically occurring separate domains, with at least a first and a second domain, said first domain comprising a polymeric species containing an inorganic species capable of forming a ceramic oxide, said polymeric species containing an inorganic species capable of forming a ceramic oxide being formed of a polymerized monomer containing an inorganic species capable of forming a ceramic oxide, said inorganic species present in an amount of at least about 3 atomic% based on the total number of atoms in the first domain, and said second domain comprising a polymeric species not containing a sufficient quantity of inorganic species to be capable of forming a ceramic oxide and that is selectively degradable and removable from the polymeric article, where the polymerized monomer containing an inorganic species capable of forming a ceramic oxide has a glass transition temperature of at least about 0 degrees C, and polymers comprising the polymeric article have an average molecular weight of at least about 30,000 Da.

3. (Withdrawn) A system comprising:

an article including a periodic structure of a plurality of periodically occurring separate domains having a plurality of boundaries between said domains defining a plurality of interfaces, with at least a first and second domain having a boundary therebetween defining at least one interface, and said first domain including an oxidized polymeric species forming an inorganic oxide

ceramic and said second domain at least partially comprised of void space, where an interface between the domains is at least partially comprised of the inorganic oxide ceramic, said inorganic oxide ceramic forming a layer at at least a portion of said interface that is at least 1 nm thick.

4. (Withdrawn) A system comprising:

a block copolymeric species having at least two blocks A and B, the blocks A and B being incompatible with each other such that the block copolymeric species is self-assembleable into a three-dimensionally periodic polymeric article including a structure of a plurality of separate domains, with at least a first and a second domain each being topologically continuous and defined by association of similar blocks of the copolymeric species, with at least block A comprising a polymeric species containing an inorganic species capable of forming a ceramic oxide, said inorganic species present in an amount of at least about 3 atomic% based on the total number of atoms in block A.

5. (Withdrawn) A method comprising:

processing a block copolymeric species, including at least one block comprising a polymeric species containing an inorganic species capable of forming a ceramic oxide, said inorganic species present in an amount of at least about 3 atomic% based on the total number of atoms in said block, to produce a phase separated multi-domain three-dimensionally periodic polymeric article including a structure of a plurality of separate domains, with at least a first and a second domain each being topologically continuous and defined by association of similar blocks of the copolymeric species.

6. (Withdrawn) A system comprising:

a block copolymeric species having at least two blocks A and B, the blocks A and B being incompatible with each other such that the block copolymeric species is self-assembleable into a periodic polymeric article including a structure of a plurality of separate domains, with at least a first and a second domain each being defined by association of similar blocks of the copolymeric species, with at least one of said blocks comprising a polymeric species containing an inorganic species capable of forming a ceramic oxide, said polymeric species containing an inorganic species

capable of forming a ceramic oxide being formed of a polymerized monomer containing an inorganic species capable of forming a ceramic oxide, and at least one other block comprising a polymeric species not containing a sufficient quantity of inorganic species to be capable of forming a ceramic oxide and that is selectively degradable and removable from the polymeric article; said polymerized monomer having a content of said inorganic species of at least about 3 atomic% based on the total number of atoms in said polymerized monomer, and a glass transition temperature of at least about 0 degrees C, said block copolymeric species having an average molecular weight of at least about 30,000 Da.

7. (Withdrawn) A method comprising:

processing a block copolymeric species to produce a phase separated multi-domain periodic polymeric article including a structure of a plurality of separate domains, with at least a first and a second domain each being defined by association of similar blocks of the copolymeric species, the block copolymeric species including at least one block comprising a polymeric species containing an inorganic species capable of forming a ceramic oxide, said polymeric species containing an inorganic species capable of forming a ceramic oxide being formed of a polymerized monomer containing an inorganic species capable of forming a ceramic oxide, and at least one other block comprising a polymeric species not containing a sufficient quantity of inorganic species to be capable of forming a ceramic oxide and that is selectively degradable and removable from the polymeric article, with said polymerized monomer having a content of said inorganic species of at least about 3 atomic% based on the total number of atoms in said polymerized monomer and a glass transition temperature of at least about 0 degrees C, and with said block copolymeric species having an average molecular weight of at least about 30,000 Da.

8. (Withdrawn) The system of claim 1, wherein said polymeric species containing an inorganic species capable of forming a ceramic oxide comprises a silicon-containing polymeric species.

9. (Withdrawn) The system of claim 2, wherein said polymerized monomer containing an inorganic species capable of forming a ceramic oxide comprises a silicon-containing polymeric species.

10. (Withdrawn) The system of claim 2, wherein the polymeric article includes a polymeric material self-assembled into a periodic structure of a plurality of periodically occurring separate domains, comprising at least the first and the second domain.

11. (Withdrawn) The system of claim 1, wherein said second domain comprises a polymeric species not containing a sufficient quantity of inorganic species to be capable of forming a ceramic oxide.

12. (Withdrawn) The system of claim 3, wherein said void space is formed by at least partial removal of a precursor polymeric species not containing a sufficient quantity of inorganic species to be capable of forming a ceramic oxide from a precursor periodic polymeric article.

13. (Withdrawn) The system of claim 12, wherein the precursor periodic polymeric article includes a polymeric material self-assembled into a periodic structure of a plurality of periodically occurring separate domains, with at least a first and a second domain.

14. (Withdrawn) The system of claims 2, wherein said second domain at least partially comprises void space formed by at least partial removal of the polymeric species not containing a sufficient quantity of inorganic species to be capable of forming a ceramic oxide from the periodic structure.

15. (Withdrawn) The system of claim 14, wherein said first domain includes an inorganic oxide ceramic formed by oxidation of the polymeric species containing an inorganic species.

16. (Withdrawn) The system of claim 1, wherein said polymeric species containing an inorganic species capable of forming a ceramic oxide is comprised of a polymerized monomer, the monomer containing an inorganic species capable of forming a ceramic oxide.

17. (Currently Amended) The system of claim 1~~2~~, wherein the first and second domains of the polymeric article comprise a block copolymeric species having at least two blocks A and B that are assembled into the first and second domains respectively.

18. (Withdrawn) The system of claim 17, wherein the block copolymeric species has at least three blocks A, B, and C.

19. (Withdrawn) The system of claim 2, wherein at least one domain further contains an auxiliary component.

20. (Withdrawn) The system of claim 19, wherein said auxiliary component modifies the volume fraction of the domain in which it is present.

21. (Withdrawn) The system of claim 20, wherein said auxiliary component is a homopolymeric species.

22. (Withdrawn) The system of claim 19, wherein said auxiliary component is a particulate.

23. (Previously presented) The system of claim 1, wherein said polymeric species has a glass transition temperature of at least about 0 degrees C.

24. (Previously presented) The system of claim 1, wherein the polymeric species comprise polymers having an average molecular weight of at least about 30,000 Da.

25. (Withdrawn) The system of claim 2, wherein the polymeric species comprise polymers having a polydispersity of no more than two.

26. (Withdrawn) The system of claim 3, wherein said second domain is subsequently at least partially filled with a material that cannot be formed into a periodic structure by self-assembly.

27. (Withdrawn) The system of claim 3, wherein said void space is made electrically conducting, thus creating a conducting network.

28. (Withdrawn) The system of claim 3, wherein the article has at least a first side and a second side with at least one void space providing a continuous pathway for fluid communication between said first side and said second side so that the article functions as a membrane.

29. (Withdrawn) The method of claim 7, comprising allowing the block copolymeric species to self-assemble into the phase separated polymeric multi-domain periodic structure.

30. (Withdrawn) An article comprising:

a periodic structure of a plurality of periodically occurring separate domains, with at least a first and a second domain, said first and second domains having a structure defined by self assembly of at least one polymeric species and with at least one domain comprising a molded structure formed of at least one of a liquid or solid material that cannot be formed into a periodic structure by self-assembly, with each domain that is not formed of said material being essentially free of said material.

31. (Withdrawn) The article of claim 30, wherein the article has an at least three-dimensionally periodic structure.

32. (Withdrawn) The article of claim 30, wherein said material is a polymer that cannot be formed into a periodic structure by self-assembly.

33. (Withdrawn) The article of claim 32, wherein said polymer that cannot be formed into a periodic structure by self-assembly is a fluorine-containing polymer.

34. (Withdrawn) The article of claim 33, wherein said polymer that cannot be formed into a periodic structure by self-assembly is poly(tetrafluoroethylene).

35. (Withdrawn) The article of claim 30, wherein said material is a conducting polymer.

36. (Withdrawn) The article of claim 30, wherein said material is a metal.

37. (Withdrawn) The article of claim 36, wherein said metal is a liquid having a melting temperature of at least about 400 degrees C.

38. (Withdrawn) The article of claim 30, wherein said material is a material having a dielectric constant greater than three.

39. (Withdrawn) The article of claim 30, wherein said material is a magnetic material.

40. (Withdrawn) The article of claim 39, wherein said magnetic material is disposed on the surface of a substrate.

41. (Withdrawn) The system of claim 2, wherein the structure has a photonic band gap in at least one direction for electromagnetic radiation of at least one wavelength within the range of about 20 nm to about 1 μm.

42. (Withdrawn) The article of claim 30, wherein the article has an at least one-dimensionally periodic structure.

43. (Withdrawn) The article of claim 30, wherein the article has an at least two-dimensionally periodic structure.

44. (Withdrawn) The article of claim 30, wherein the domains that are essentially free of said material comprise void space.

45. (Withdrawn) The article of claim 30, wherein the domains that are essentially free of said material are at least partially comprised of an inorganic oxide ceramic.

46. (Withdrawn) A membrane comprising:

a periodic structure, including a plurality of periodically occurring void spaces defining a plurality of pores, the membrane having at least a first side and a second side, where at least one of said pores provides a continuous pathway for fluid communication between said first side and said second side, said at least one pore having a surface at least partially comprised of an oxidized polymeric species forming an inorganic oxide ceramic.

47. (Withdrawn) A mold comprising:

a periodic structure, including a plurality of periodically occurring void spaces therein, where at least one of said void spaces provides a continuous pathway for fluid communication with the atmosphere surrounding said structure, with at least one void space providing a continuous pathway for fluid communication with the atmosphere surrounding said structure having a surface at least partially comprised of an oxidized polymeric species forming an inorganic oxide ceramic, said inorganic oxide ceramic forming a layer at least 1 nm thick at at least a portion of said surface.

48. (Withdrawn) A method comprising:

creating a periodic structure of a material by providing a mold comprising a periodic structure including a plurality of periodically occurring void spaces, with at least one void space having a surface at least partially comprised of an oxidized polymeric species forming an inorganic oxide ceramic, said inorganic oxide ceramic forming a layer at least 1 nm thick; and

at least partially filling said void space with said material.

49. (Withdrawn) The mold of claim 47, wherein said void spaces have a characteristic minimum dimension of between 1 nm and 1 μm.

50. (Withdrawn) The membrane of claim 46, wherein said pores are present at the surface of said first side and said second side at a density of at least about 10^3 per square centimeter.

51. (Withdrawn) The membrane of claim 46, said pores are present at the surface of said first side and said second side at a density of at least about 10^{10} per square centimeter.

52. (Withdrawn) The mold of claim 47, wherein said inorganic oxide ceramic is comprised of an oxidized silicon-containing polymeric species.

53. (Withdrawn) The membrane of claim 46, wherein the membrane forms a coating layer on a substrate.

54. (Withdrawn) The membrane of claim 53, wherein the coating layer is thermally stable at temperatures of at least about 400°C.

55. (Withdrawn) The membrane of claim 46, wherein the structure is one-dimensionally periodic.

56. (Withdrawn) The membrane of claim 46, wherein the structure is two-dimensionally periodic.

57. (Withdrawn) The membrane of claim 56, wherein said void spaces are in the shape of essentially circular cylinders.

58. (Withdrawn) The membrane of claim 57, wherein said void spaces are non-overlapping and non-intersecting.

59. (Amended) The mold of claim 47, wherein the structure is three-dimensionally periodic.

60. (Withdrawn) The mold of claim 59, wherein said void spaces form an interconnected continuous network of pathways within said structure having a plurality of nodes.

61. (Withdrawn) The mold of claim 60, wherein said void spaces are made conducting, thus forming a conducting network.

62. (Withdrawn) A photonic band gap article comprising:

a periodic structure of a plurality of periodically occurring separate domains, with at least a first and a second domain, said structure including at least one interface defined by a surface of contact between said first domain and said second domain, which interface is at least partially comprised of a layer of an oxidized polymeric species forming an inorganic oxide ceramic, said layer being at least about 1 nm thick, where the structure inhibits the propagation of electromagnetic radiation of at least one wavelength within the range of about 20 nm to about 1 μm.

63. (Withdrawn) A low dielectric constant material comprising:

a periodic structure of a plurality of periodically occurring separate domains, with at least a first and a second domain, at least one domain being at least partially comprised of void space, and at least one other domain being at least partially comprised of an inorganic oxide ceramic; said structure having a dielectric constant less than about 3.

64. (Withdrawn) A high dielectric constant material comprising:

a periodic molded structure of a plurality of periodically occurring separate domains, with at least a first and a second domain, said structure having a dielectric constant greater than about 3.

65. (Withdrawn) The high dielectric constant material of claim 64, where said structure has a dielectric constant greater than about 5.

66. (Withdrawn) The high dielectric constant material of claim 64, where said structure has a dielectric constant greater than about 8.

67. (Withdrawn) The high dielectric constant material of claim 64, where said structure has a dielectric constant greater than about 8.5.

68. (Withdrawn) The high dielectric constant material of claim 64, where said structure has a dielectric constant greater than about 10.

69. (Withdrawn) A method comprising:

forming a polymeric article including a periodic structure of a plurality of periodically occurring separate domains, with at least a first and a second domain, said first domain comprising a polymeric species containing an inorganic species capable of forming capable of forming a ceramic oxide, said inorganic species present in an amount of at least about 3 atomic% based on the total number of atoms in said first domain;

at least partially removing at least one domain from the structure; and

at least partially oxidizing the structure to form an inorganic oxide ceramic.

70. (Withdrawn) The method of claim 69, wherein said article is formed to include at least one domain comprising a polymeric species not containing a sufficient quantity of inorganic species to be capable of forming an inorganic oxide ceramic.

71. (Withdrawn) The method of claim 70, wherein said at least one domain comprising a polymeric species not containing a sufficient quantity of inorganic species to be capable of forming an inorganic oxide ceramic is formed of a polymeric species that has a chain with a plurality of unsaturated bonds.

72. (Withdrawn) The method of claim 70, comprising allowing the polymeric article to form by self-assembly of polymeric material into a periodic structure of a plurality of periodically occurring separate domains, with at least a first and a second domain.

73. (Withdrawn) The method of claim 72, wherein the polymeric article is formed by self-assembly of a block copolymeric species having at least two blocks A and B that are assembled into the first and second domains respectively.

74. (Withdrawn) The method of claim 69, wherein the polymeric species containing an inorganic species capable of forming an inorganic oxide ceramic comprises a silicon-containing polymeric species.

75. (Withdrawn) The method of claim 70, wherein said article is formed with said at least one domain comprising a polymeric species not containing a sufficient quantity of inorganic species to be capable of forming an inorganic oxide ceramic comprising a non-silicon-containing polymeric species.

76. (Withdrawn) The method of claim 70, wherein said at least one domain comprising a polymeric species not containing a sufficient quantity of inorganic species to be capable of forming an inorganic oxide ceramic is at least partially removed in the removing step.

77. (Withdrawn) The method of claim 69, wherein said at least one domain comprising a polymeric species containing an inorganic species capable of forming an inorganic oxide ceramic is oxidized in the oxidizing step.

78. (Withdrawn) The method of claim 69, wherein the removing step and the oxidizing step are performed simultaneously.

79. (Withdrawn) The method of claim 69, wherein the removing step is performed prior to the oxidizing step.

80. (Withdrawn) The method of claim 69, wherein the oxidizing step is performed prior to the removing step.

81. (Withdrawn) The method of claim 69, wherein the removing step includes exposing the article to a chemical oxidizer.

82. (Withdrawn) The method of claim 81, wherein the chemical oxidizer is ozone.

83. (Withdrawn) The method of claim 82, wherein the ozone is provided as a gas.

84. (Withdrawn) The method of claim 82, wherein the ozone is provided in a liquid solution.

85. (Withdrawn) The method of claim 69, wherein the removing step includes exposing the article to radiation.

86. (Withdrawn) The method of claim 85, wherein the radiation is ultraviolet light.

87. (Withdrawn) The method of claim 69, wherein the removing step includes exposing the article to oxygen plasma etching.

88. (Withdrawn) The method of claim 87, wherein the article is exposed to oxygen reactive ion etching.

89. (Withdrawn) The method of claim 69, wherein the removing step includes exposing the article to a combination of a chemical oxidizer and radiation.

90. (Withdrawn) The method of claim 69, wherein the removing step includes exposing the article to a combination of a chemical oxidizer and oxygen plasma etching.

91. (Withdrawn) The method of claim 69, wherein the removing step includes exposing the article to a combination of a radiation and oxygen plasma etching.

92. (Withdrawn) The method of claim 69, wherein the removing step includes exposing the article to an electron beam.

93. (Withdrawn) The method of claim 69, wherein the removing step includes exposing the article to heat.

94. (Withdrawn) The method of claim 69, wherein the removing step includes exposing the article to a base.

95. (Withdrawn) The method of claim 69, wherein the removing step includes exposing the article to a solvent.

96. (Withdrawn) The method of claim 69, wherein the oxidizing step includes exposing the article to a chemical oxidizer.

97. (Withdrawn) The method of claim 96, wherein the chemical oxidizer is ozone.

98. (Withdrawn) The method of claim 97, wherein the ozone is provided as a gas.

99. (Withdrawn) The method of claim 97, wherein the ozone is provided in a liquid solution.

100. (Withdrawn) The method of claim 69, wherein the oxidizing step includes exposing the article to radiation.

101. (Withdrawn) The method of claim 100, wherein the radiation is ultraviolet light.

102. (Withdrawn) The method of claims 69, wherein the oxidizing step includes exposing the article to oxygen plasma etching.

103. (Withdrawn) The method of claim 102, wherein the article is exposed to oxygen reactive ion etching.

104. (Withdrawn) The method of claim 69, wherein the oxidizing step includes exposing the article to a combination of a chemical oxidizer and radiation.

105. (Withdrawn) The method of claim 69, wherein the oxidizing step includes exposing the article to a combination of a chemical oxidizer and oxygen plasma etching.

106. (Withdrawn) The method of claim 69, wherein the oxidizing step includes exposing the article to a combination of a radiation and oxygen plasma etching.

107. (Withdrawn) A method for forming a conducting network comprising:

providing a polymeric article including a periodic structure of a plurality of periodically occurring separate domains, with at least a first and a second domain;

at least partially removing at least one domain to form at least one void space; and

at least partially filling said void space with a conducting material to form at least one conducting pathway.

108. (Withdrawn) The method of claim 107 further comprising before the filling step, the step of at least partially oxidizing the structure to form an inorganic oxide.

109. (Withdrawn) A method comprising:

at least partially oxidizing a polymeric article, the article including a periodic structure of a plurality of periodically occurring separate domains, with at least a first and a second domain, said first domain comprising a polymeric species containing an inorganic species capable of forming a ceramic oxide, said inorganic species present in an amount of at least about 3 atomic% based on the total number of atoms in said first domain, where at least one domain of said structure has been at least partially removed, to form an inorganic oxide ceramic.

110. (Withdrawn) A method for forming a magnetic article comprising:

forming a polymeric article including a periodic structure of a plurality of periodically occurring separate domains, with at least a first and a second domain;

at least partially removing at least one domain to form at least one void space; and

adding a magnetic material to the void space so as to at least partially fill the void space with the magnetic material.

111. (Withdrawn) A method for forming a magnetic article comprising:

forming on a substrate a polymeric article including a periodic structure of a plurality of periodically occurring separate domains, with at least a first and a second domain;

at least partially removing at least one domain to form at least one void space; and

adding a magnetic material to at least one void space.

112. (Withdrawn) The method of claim 110, wherein the article is formed on a substrate during the forming step.

113. (Withdrawn) The method of claim 110, further comprising before the adding step:

at least partially oxidizing the structure to form an inorganic oxide.

114. (Withdrawn) The method of claim 111, further comprising:

removing the article from the substrate, while leaving behind on the substrate at least a portion of the magnetic material.

115. (Withdrawn) The method of claim 111, wherein the forming step comprises:
providing the substrate;
coating the substrate with a polymeric layer; and
converting the layer into said polymeric article.

116. (Withdrawn) The method of claim 111, wherein the forming step comprises:
providing the substrate; and
attaching said polymeric article to the substrate.

117. (Withdrawn) The method of claim 110, wherein at least one domain of the polymeric article is at least partially oxidized during the removing step.

118. (Withdrawn) The method of claim 111, wherein the adding step comprises at least partially filling said void space with the magnetic material.

119. (Withdrawn) The method of claim 110, wherein the polymeric article has an at least one-dimensionally periodic structure.

120. (Withdrawn) The method of claim 111, wherein the polymeric article has an at least two-dimensionally periodic structure.

121. (Withdrawn) The method of claim 110, wherein the polymeric article has a three-dimensionally periodic structure.

122. (Withdrawn) The method of claim 110, wherein domains that are at least partially removed during the removing step are non-interconnected.

123. (Withdrawn) The method of claim 111, wherein during the adding step, the magnetic material is deposited into the void space by electrodeposition.

124. (Withdrawn) The method of claim 123, wherein at least a portion of the a surface of the substrate in contact with the polymeric article comprises an electrical conductor.

125. (Withdrawn) The method of claim 110, wherein during the adding step, the magnetic material is deposited into the void space by vapor deposition.

126. (Withdrawn) The method of claim 125, wherein the magnetic material is deposited by chemical vapor deposition.

127. (Withdrawn) The method of claim 125, wherein the magnetic material is deposited by physical vapor deposition.

128. (Withdrawn) The method of claim 127, wherein the magnetic material is deposited by evaporation.

129. (Withdrawn) The method of claim 127, wherein the magnetic material is deposited by sputtering.

130. (Withdrawn) The method of claim 120, wherein the at least one domain at least partially removed during the removing step is oriented with a longitudinal axis that is non-coplanar to a surface of the substrate in contact with the polymeric article.

131. (Withdrawn) The method of claim 120, wherein the at least one domain at least partially removed during the removing step is oriented with a longitudinal axis that is essentially perpendicular to a surface of the substrate in contact with the polymeric article.

132. (Withdrawn) The method of claim 120, wherein the at least one domain at least partially removed during the removing step is essentially cylindrical in shape.

133. (Withdrawn) A magnetic article comprising:

a three-dimensionally periodic structure of a plurality of periodically occurring separate domains, with at least a first and a second domain, at least one domain having a characteristic dimension not greater than 1 μm and including a magnetic material, with each domain that includes a magnetic material being non-interconnected.

134. (Withdrawn) A magnetic article comprising:

a periodic structure of a plurality of periodically occurring separate domains, with at least a first and a second domain, said first and second domains having a structure defined by self-assembly of at least one polymeric species, at least one domain including a magnetic material, with each domain that includes a magnetic material being non-interconnected.

135. (Withdrawn) The article of claim 134, wherein the at least one domain including a magnetic material is at least partially surrounded by void space.

136. (Withdrawn) The article of claim 134, wherein the at least one domain including a magnetic material is at least partially surrounded by a polymeric material.

137. (Withdrawn) The article of claim 134, wherein the at least one domain including a magnetic material is at least partially surrounded by an inorganic oxide ceramic.

138. (Withdrawn) The article of claim 134, further comprising a substrate in contact with a surface of the at least one domain including a magnetic material.

139. (Withdrawn) The article of claim 138, wherein a surface of the substrate in contact with the surface of at least one domain including a magnetic material comprises an electrical conductor.

140. (Withdrawn) The article of claim 134, wherein the at least one domain including a magnetic material has a characteristic dimension between about 10 nm and about 50 nm.

141. (Withdrawn) The article of claim 134, wherein domains including a magnetic material are separated from each other by a minimum distance of between about 1 nm and about 20 nm.

142. (Withdrawn) The article of claim 134, wherein the at least one domain including a magnetic material consists essentially of the magnetic material.

143. (Withdrawn) The article of claim 134, wherein the magnetic material is selected from at least one of cobalt, nickel, iron, alloys of cobalt and platinum, alloys of cobalt and iron, oxides thereof, and barium ferrite.

144. (Withdrawn) The article of claim 134, wherein the periodic structure is at least one-dimensionally periodic.

145. (Withdrawn) The article of claim 134, wherein the periodic structure is at least two-dimensionally periodic.

146. (Withdrawn) The article of claim 145, wherein the at least one domain including a magnetic material is oriented with a longitudinal axis that is non-coplanar to a surface of a substrate in contact with a surface of the domain including a magnetic material.

147. (Withdrawn) The article of claim 145, wherein the at least one domain including a magnetic material is oriented with a longitudinal axis that is essentially perpendicular to a surface of a substrate in contact with a surface of the domain including a magnetic material.

148. (Withdrawn) The article of claim 145, wherein the at least one domain including a magnetic material is essentially cylindrical in shape.

APPENDIX B

No evidence pursuant to §§ 1.130, 1.131, or 1.132 and/or evidence entered by or relied upon by the examiner that is relevant to this appeal is being submitted.

APPENDIX C

No related proceedings are referenced in II. above, hence copies of decisions in related proceedings are not provided.